AD-771 945

CONCEPT FOR A MULTIPLE PERSONNEL AIRDROP SYSTEM

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Natick, Massachusetts

November 1973

Unclassified
Security Classification

AD 771945

DOCUMENT CONTROL DATA - R & D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY *(Corporate author)*
U. S. Army Natick Laboratories
Natick, Massachusetts 01760

2a. REPORT SECURITY CLASSIFICATION
UNCLASSIFIED

2b. GROUP

3. REPORT TITLE
CONCEPT FOR A MULTIPLE PERSONNEL AIRDROP SYSTEM

4. DESCRIPTIVE NOTES *(Type of report and inclusive dates)*

5. AUTHOR(S) *(First name, middle initial, last name)*
James F. Falcone

6. REPORT DATE	7a. TOTAL NO. OF PAGES	7b. NO. OF REFS
	13	1

8a. CONTRACT OR GRANT NO.	9a. ORIGINATOR'S REPORT NUMBER(S)
b. PROJECT NO. 1F162203AA33	74-15-AD
c.	9b. OTHER REPORT NO(S) *(Any other numbers that may be assigned this report)*
d.	

10. DISTRIBUTION STATEMENT
Approved for public release; distribution unlimited.

11. SUPPLEMENTARY NOTES	12. SPONSORING MILITARY ACTIVITY
	US Army Natick Laboratories Natick, Massachusetts 01760

13. ABSTRACT

In order to achieve significant improvement in the Army's airdrop capabilities, unconventional and even radical concepts along with more sophisticated techniques must be considered. The standard technique of airborne troops exiting one at a time from current large, high speed aircraft results in a dispersion of troops on the drop zone which has become a critical limitation on the deployment of airborne forces.

One valid concept for reduction of dispersion employs multiple exit of troops from the aircraft. This can be accomplished by use of a container or structure which will deliver a squad size, or larger, fighting unit completely equipped and ready for immediate action upon landing. A particular configuration of a multiple personnel airdrop system is described in detail along with some suggested variations and options of the basic concept. The particular configuration used to illustrate the concept was selected because the feasibility, engineering analyses and design studies had already been conducted in sufficient depth to define realistic operational and physical characteristics for a practical system.

DD FORM 1 NOV 68 1473 REPLACES DD FORM 1473, 1 JAN 64, WHICH IS OBSOLETE FOR ARMY USE.

Unclassified
Security Classification

14 KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Airdrop Operations	8		8		9	
Aerial Delivery	8				9	
Airdrop System	8		8		9	
Personnel	9		9		9	
Military Personnel	9		9		9	
Multiple	0		0		0	
Deployment	4					
Dispersion	4					
Drop Zones	4					
Concept			8			
Container			10			
Structure			10			
Feasibility					8	
Variations					8	
Options					8	

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Technical Report

74-15-AD

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Project Reference
1F162203AA33

November 73

AIRDROP ENGINEERING LABORATORY
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NATICK, MASS. 01760

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FOREWORD

The basic concept of airdropping groups of people in contrast to the conventional method of individual paratroopers is not new. It provides a rather obvious and logical means for achieving low dispersion and greater troop density on the drop zone.

In 1962-63, as part of the exploratory investigation of Ground Proximity Aerial Delivery System (GPADS), a comprehensive study was conducted to determine the feasibility of, and basic design characteristics for, a 12 man delivery system.

This report highlights the characteristics of a multiple personnel airdrop concept based on the prior work augmented with some suggested variations and options which are currently feasible. The report was prepared because the drop zone dispersion problem currently presents a critical limitation on the deployment of airborne forces. It is hoped that this document will stimulate interest in this problem area and inspire additional thinking in directions which will evolve into new operational concepts and/or requirements.

This is part of a continuing overall effort to identify and evaluate all valid concepts which offer potential solution to known problems and/or offer potential for significant improvements in the Army's airdrop capabilities.

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ABSTRACT

In order to achieve significant improvement in the Army's airdrop capabilities, unconventional and even radical concepts along with more sophisticated techniques must be considered. The standard technique of airborne troops exiting one at a time from current large, high speed aircraft results in a dispersion of troops on the drop zone which has become a critical limitation on the deployment of airborne forces.

One valid concept for reduction of dispersion employs multiple exit of troops from the aircraft. This can be accomplished by use of a container or structure which will deliver a squad size, or large, fighting unit completely equipped and ready for immediate action upon landing. A particular configuration of a multiple personnel airdrop system is described in detail along with some suggested variations and options of the basic concept. The particular configuration used to illustrate the concept was selected because the feasibility, engineering analyses and design studies had already been conducted in sufficient depth to define realistic operational and physical characteristics for a practical system.

This concept is not purported to offer the best solution to the drop zone dispersion problem but is one of the valid alternatives which should be considered as a potential candidate for solution of this problem.

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CONCEPT FOR A MULTIPLE PERSONNEL AIRDROP SYSTEM

Introduction:

An airborne force, because it can react faster to an emergency than any other unit and deploy a balanced force to any spot on the globe without the need for prepared facilities at the destination, is considered to be the only immediately deployable force currently available in the continental US.

The relative effectiveness of airborne forces has been affected by the continual increase in the size and speed of cargo aircraft. The increase in aircraft size has permitted greater numbers of airborne troops to be delivered from a single aircraft. However, airborne troop deployment has not changed appreciably over the years and as a result the increased airspeed and larger numbers of people being deployed have resulted in a dispersion of troops on the drop zone which has become a critical limitation on deployment of airborne forces. In order to realize the full potential effectiveness of airborne troops in light of ever increasing size and speed of aircraft, it is essential that the deployment of such units be critically evaluated and completely new concepts for airborne operations be given serious consideration.

Considering the problem of drop zone dispersion, there appears to be three basic concepts for improving the current capability. First, and most obvious solution would be to decrease the time increment between troopers exiting the aircraft in order to empty the aircraft faster and increase density on the drop zone. The second alternative is to provide systems which have a steerable or gliding capability to enable individual troopers to control their flight path and land in smaller areas. The third concept is simultaneous exit of groups of individuals in contrast to current technique of individual, consecutive exit. These basic concepts are not mutually exclusive and the optimum solution may very well be a hybrid system employing various combinations of the three concepts.

The purpose of this document is to describe in some detail one particular concept which employs multiple personnel deployment. This system affords one valid solution to the problem of dispersion of the drop zone. The concept is an example of the type of alternatives which must be considered if significant advances in the Army's airdrop capability are to be achieved. It is hoped that this document will stimulate thinking in directions which will evolve into new operational concepts and/or requirements. In order to advance the state-of-the-art in Army Airdrop, concepts which employ unconventional and even radical changes in airdrop philosophy must be developed, or else only refinement and optimization of current type systems will be achieved. The system described, although not purported to be the optimum solution to the personnel dispersion problem, does provide a valid solution which has been investigated in sufficient detail to determine that it is completely feasible within the current state-of-the-art.

Concept Description - General

This concept envisions the airdrop of squad size or larger groups of people as a unit. This is accomplished by use of a container or structure with an internal cargo space provided with seats or other type support for personnel, and additional space for storage of equipment/supplies. This system will deliver a fighting unit, completely equipped and ready for immediate action upon landing without the need for assembly of individuals after drop. The container also provides some degree of physical protection during descent and after landing. In addition, the container/structure can perform some useful function after landing. Also, personnel delivered in this manner need not be parachute qualified.

This basic concept offers potential for many other options such as the addition of a mobility package which provides a self-propelled vehicle for use after landing, and various special mission configurations such as shelters, portable shops, communication centers or weather stations.

This concept would be greatly enhanced by a capability for ground-to-air pick of heavy loads by aircraft in flight. The container or vehicle used for the delivery can be readily retrieved, or re-rigged with parachutes so that aerial pick-up and subsequent drop into another area can be achieved. This capability is quite feasible within the next 10 years.

Twelve Man Personnel Delivery System

Considerable analyses and engineering studies were conducted and a preliminary design prepared for a 12 man personnel system. This study was performed in 1962 - 1963 and was conducted to determine the feasibility for delivery at altitudes of 200 feet. In order to achieve this low altitude capability, the recommended approach was a parachute/retro-rocket system. The detailed performance and physical characteristics enumerated in this report resulted from this prior study and consequently the concept description incorporates retro-rocket deceleration. It is not mandatory that personnel delivery in containers employ this particular system. This concept is presented only because the analysis and design studies have been completed and realistic characteristics for a practical system can be illustrated with this particular system. Figure 1 shows a wooden mock-up of a proposed design for a 12 man delivery system.

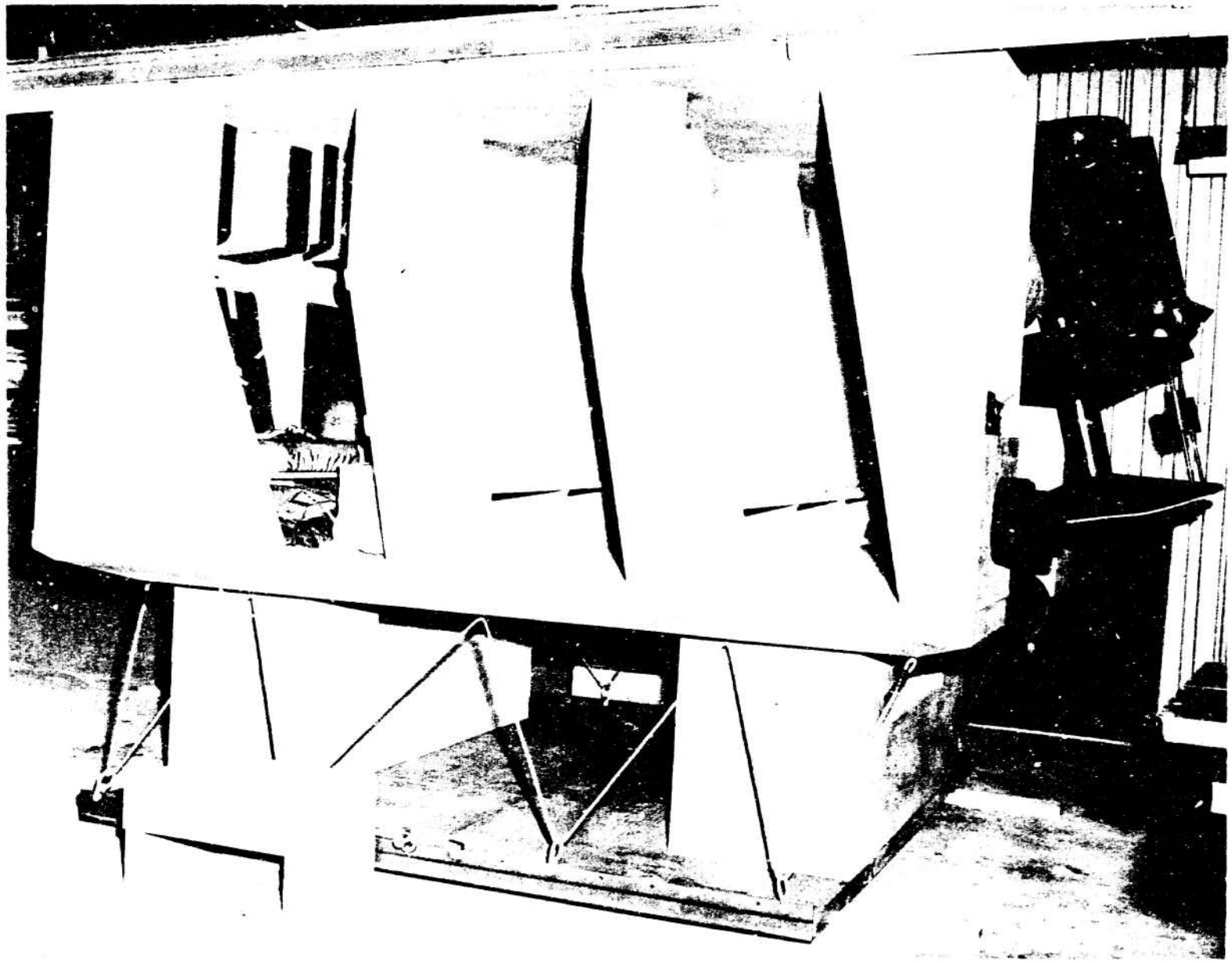

Figure 1. Wood Mock-Up of a Proposed 12-Man Delivery System.

Technical Discussion

(A) Need for New Concepts for Personnel Airdrop

Current airborne operations are conducted with C-130 and C-141 aircraft. A typical airdrop from the C-130 consists of 64 troops exiting from two doors (one on each side) simultaneously. The dispersion between the first and last man, therefore, will be approximately equal to the distance between 32 men exiting through one door. Using current standard procedures, the exit interval between individuals is approximately 1 second. For an aircraft speed of 130 knots the distance between the first and last man (at aircraft exit) is 6820 feet, (2079m).

The C-141 with a capacity of 120 jumpers (60 per door) flying at 130 knots will result in a dispersion between first and last man of 12,980 feet, (395m).

It is apparent that the present standard airborne practice coupled with current aircraft speeds and cargo capacities results in excessive dispersion of the troops. It is reasonable to expect that the trend for increasing aircraft speed will continue. Figure No. 2 shows a plot of aircraft drop speed vs year. Also shown on the plot is the aircraft crusing speed.

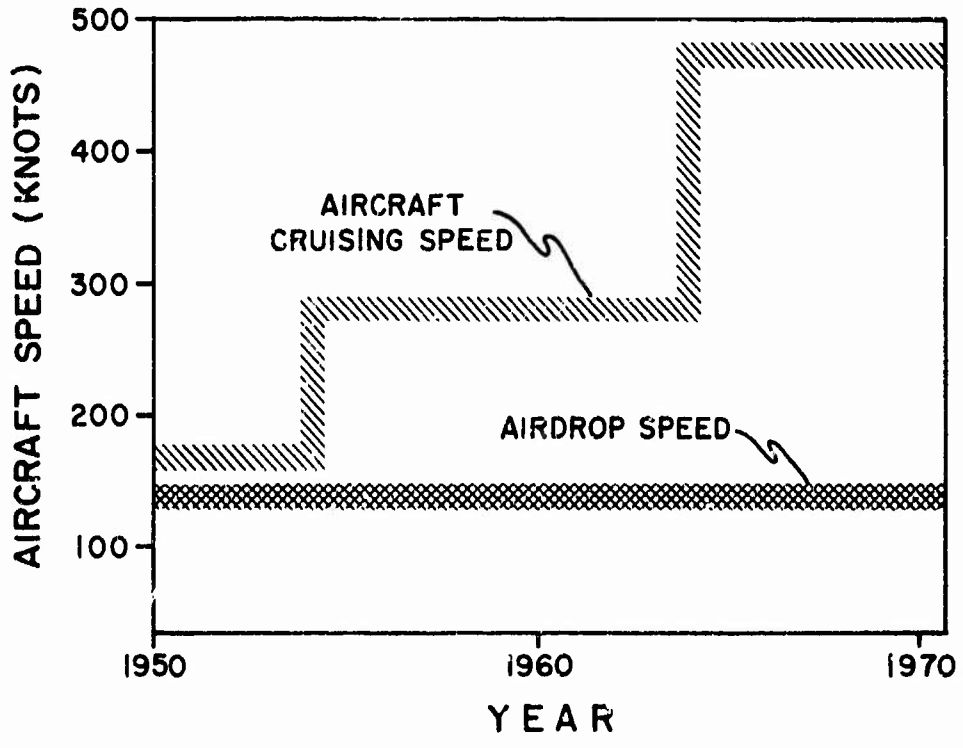

Figure 2. Airdrop Speed Capability

The gap between aircraft cruise speed and airdrop speed has widened considerably during the past 10 years. During the next 10 years it is expected that there will be an upward trend in speed used for the airdrop mission. New techniques for deployment of airborne troops must be developed in order to keep pace with the aircraft progress.

The effects of airspeed on dispersion is clearly illustrated in Figure No. 3. This shows the distance between jumpers at aircraft exit assuming a 1 second interval between jumpers.

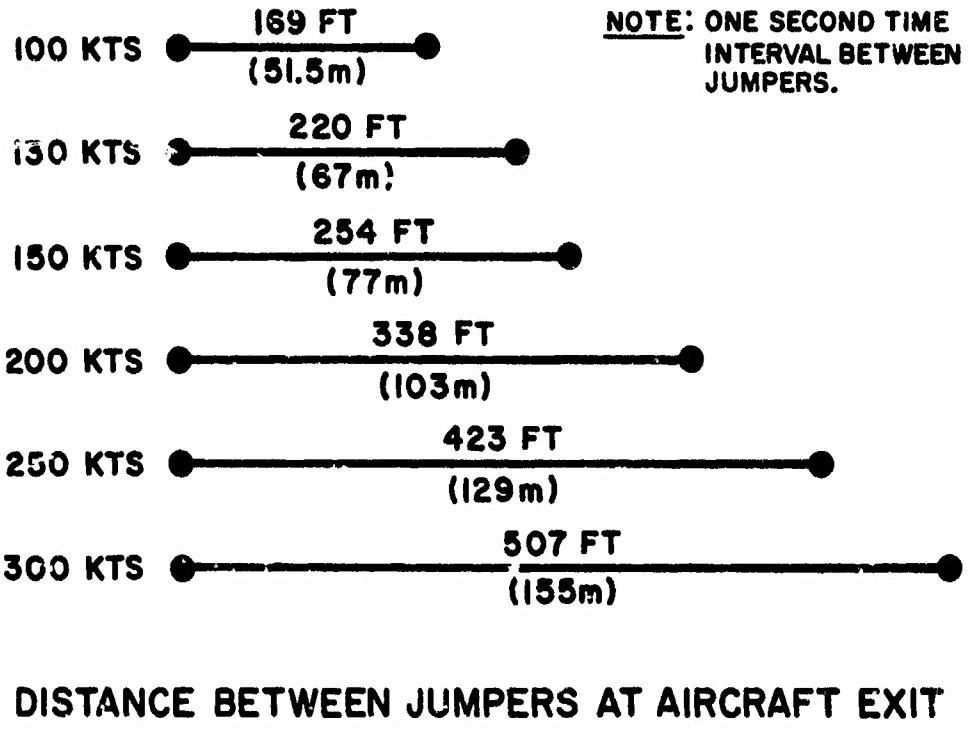

Figure 3. Effect of Aircraft Speed on Dispersion

In addition to the dispersion problem, increasing speed will impose serious physiological problems if employing individual exit of personnel from aircraft.

As the dispersion problem has been increasing, development of more accurate aircraft navigational systems has been taking place (Adverse Weather Aerial Delivery System). Figure No. 4 shows the projected improvement of aircraft position accuracy. This will enable a more accurate location of the drop zone and will increase single drop accuracy. However, even with a capability to drop the first man into a very small drop zone, the increased dispersion will mitigate any potential advantages and require large drop areas

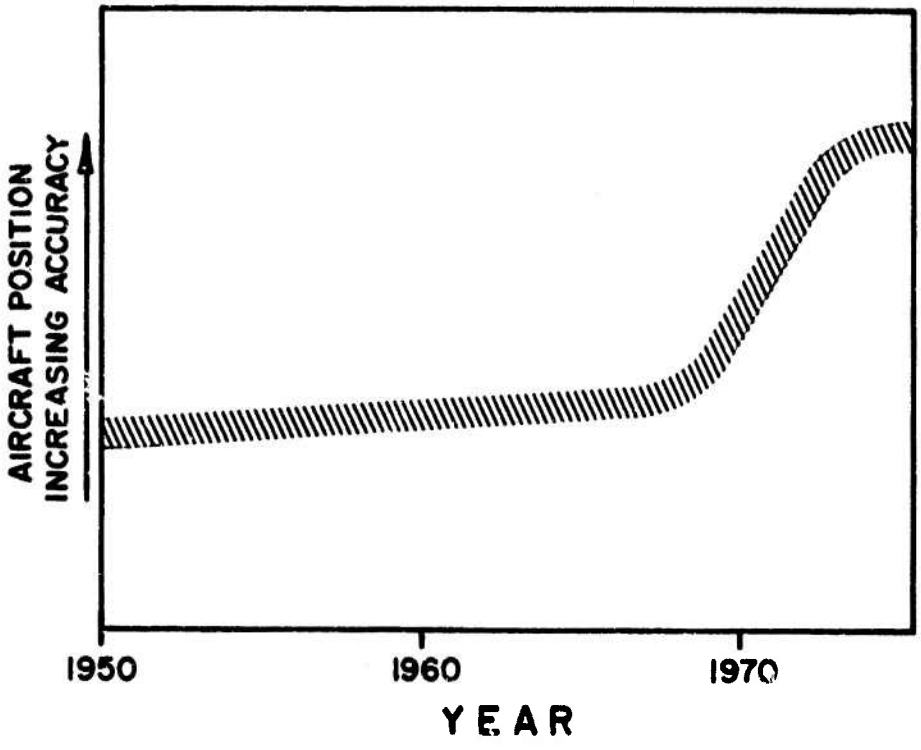

Figure 4. Aircraft Navigational Accuracy

(B) Significance of Concept for Multiple Personnel Deployment

The primary reason for delivery of personnel in groups is to decrease the dispersion on the drop zone. The extent to which it can be achieved is shown in Figure No. 5. This shows a comparison between the present method of individual exit and the personnel container concept. Although the number of personnel delivered per aircraft may be reduced if containers are used (in this particular design from 120 to 72 for the C-141 aircraft) the combat effectiveness of 120 men spread out over 2-1/2 miles can be less than that for 72 men delivered into 1/2 the area. The concept presented here has not been optimized with respect to number of people delivered. It is a very conservative design, embodying maximum room and comfort for each individual and with high structural integrity.

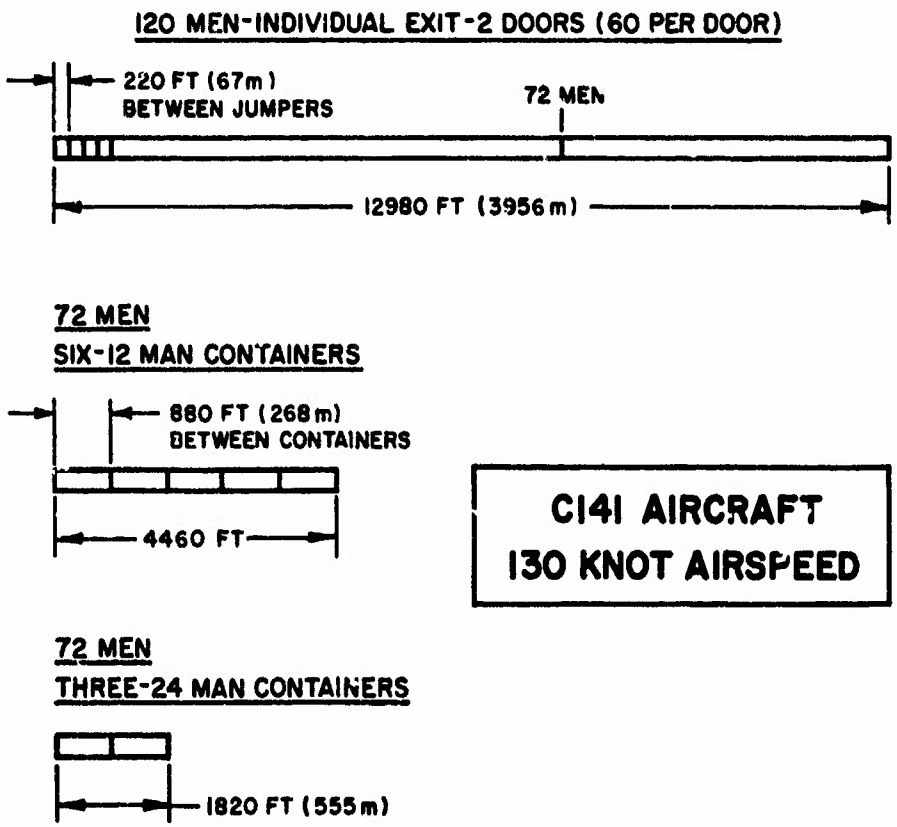

Figure 5. Theoretical Displacement at Aircraft Exit

In comparing the systems on Figure No. 5 it was assumed that the containers would be delivered at 4 sec intervals, however, it is very likely that better extraction means can be developed including simultaneous extraction of more than one container. Another alternative approach would be to develop containers for more than 12 men. The gain in drop zone density which could be realized with 24 man units is also shown on Figure No. 5.

Another significant advantage of a concept employing a structure or container for multiple personnel delivery is in the training or skill level required. Since the troops are essentially just passengers in this type delivery, there is no requirement for parachute training. Any trained soldier can be delivered in this manner.

Additionally, this concept provides considerable growth potential. Since the personnel are contained within a structure or vehicle, deployment from higher aircraft speeds is a logical extension in capability. The use of steerable or gliding decelerators would provide a substantial increase in capability. Also, the concept is a valid concept for delivery at all altitudes, and for delivery in high ground winds.

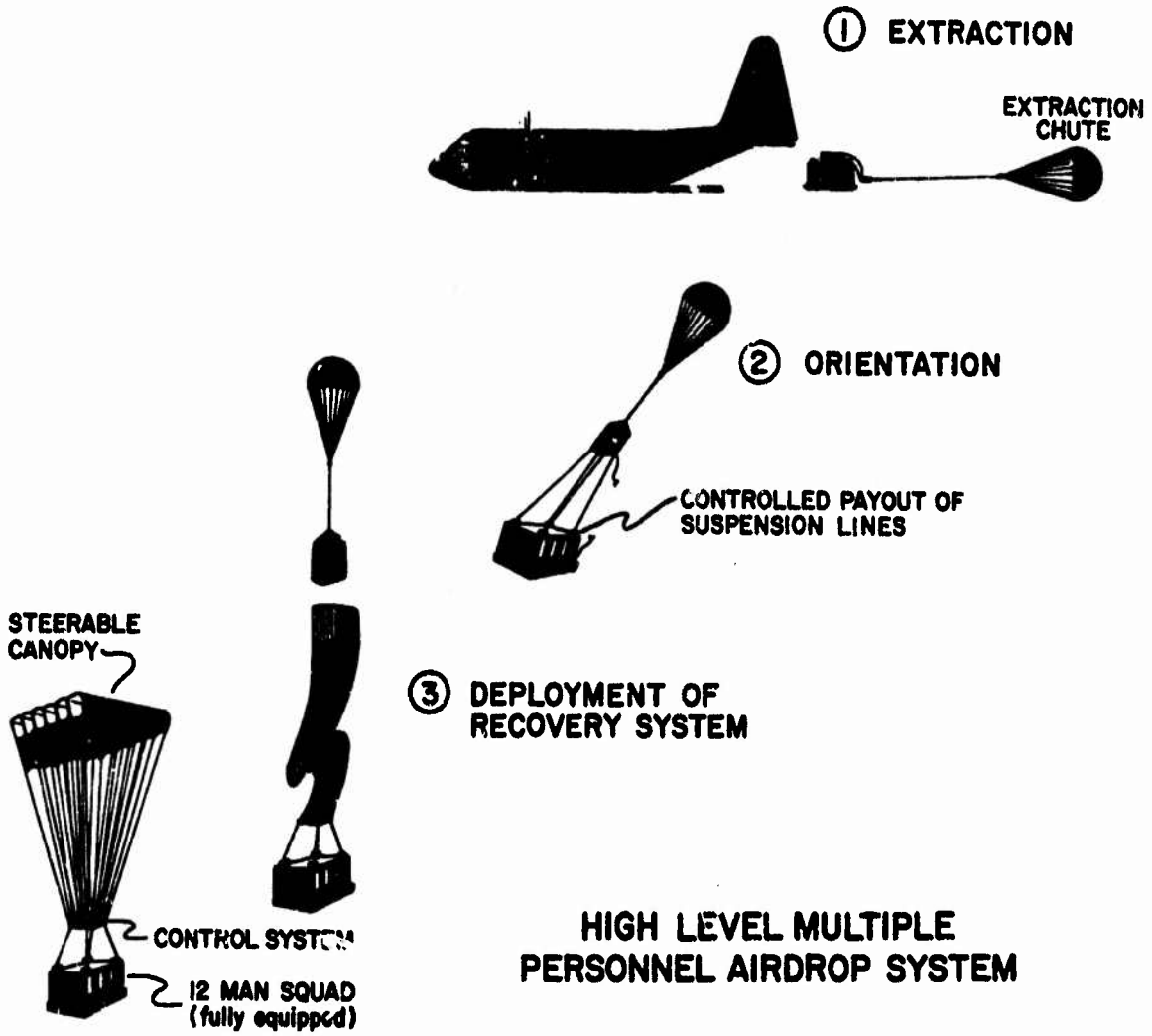

Figure 6. Multiple Personnel Concept Applied to High Altitude System

(C) Performance Characteristics

Studies were conducted to determine the feasibility of, and the design characteristics for a 12 man system for delivery from aircraft flying at 130 - 150 knots and 200 ft altitude. A drawing of the basic configuration is shown on Figure 7. The following performance characteristics were determined to be both realistic and achievable within the current state-of-the-art.

AIRDROP ALTITUDE----------200 FT. (61m)

AIRCRAFT DROP SPEED----------130-140 KNOTS (66.9-77.2 m/s)

PARACHUTE DESCENT VELOCITY----------51 FT/SEC MAX. (15.5 m/s)

MAX. FORCE DURING DESCENT----------4.0 G

ROCKET RETARDATION----------3 G for 0.5 SEC.

VELOCITY AT IMPACT----------30 FT/SEC MAX. (9.1 m/s)

MAX. IMPACT FORCE----------14 G

EMERGENCY LANDING (ROCKET FAILURE)----------31 G MAX. FORCE

(D) Physical Characteristics

Design studies were conducted for a 12 man system having the following characteristics:

PERSONAL EQUIPMENT, INCLUDING FIELD PACK, STOWED BENEATH EACH SEAT

RIFLES SECURED BETWEEN SEATS

OTHER EQUIPMENT (600 POUNDS) STOWED IN FOUR COMPARTMENTS AT EACH CORNER OF CONTAINER.

LANDING WEIGHT----------5000 POUNDS (2268 kg)

LENGTH----------10 FEET (3.1m)

WIDTH----------8 FEET (2.4m)

HEIGHT (with Energy Dissipater)----------7 FEET (2.1m)

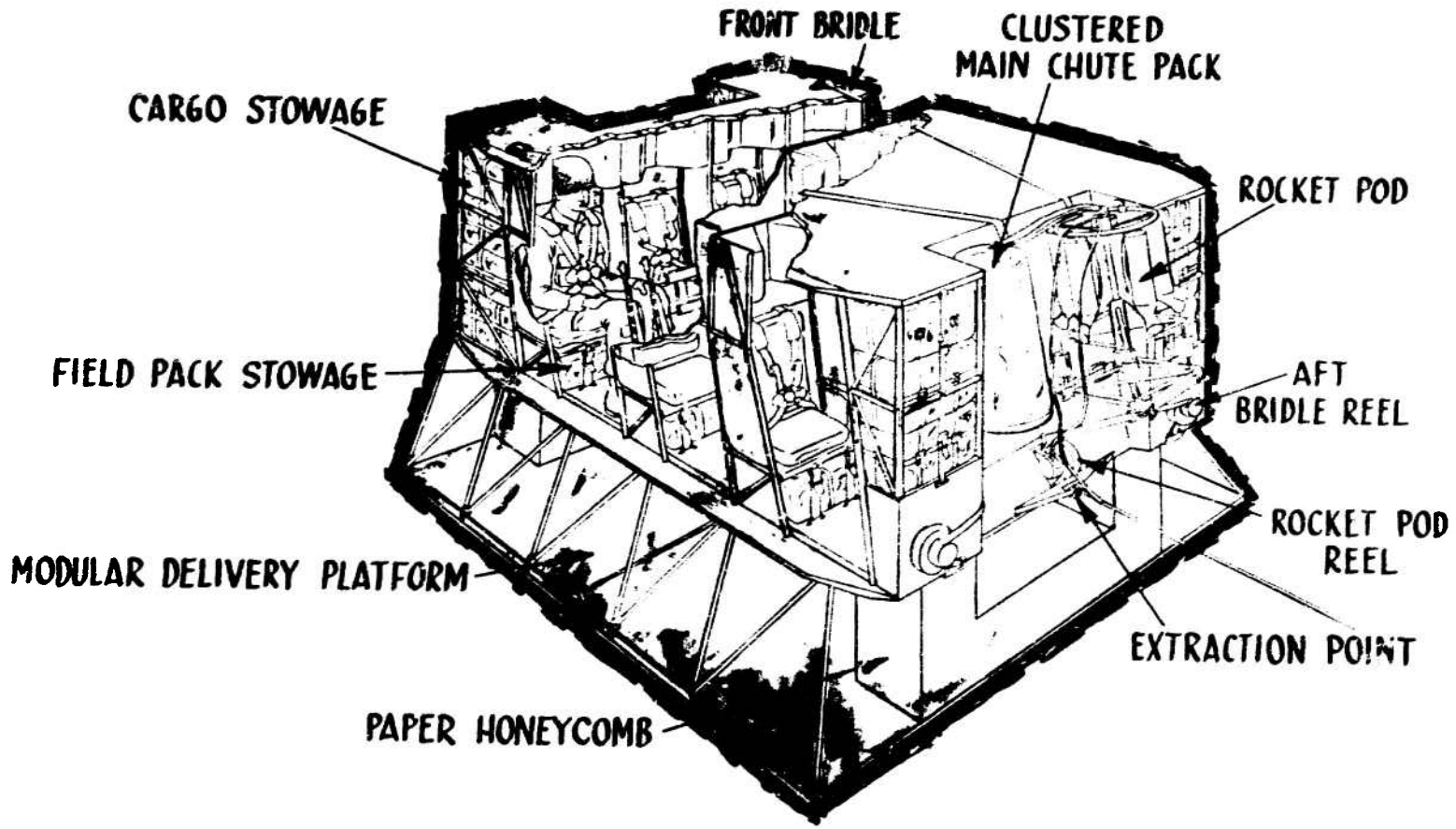

Figure 7. Drawing of a Proposed 12-Man Low Altitude Delivery System

Conclusion

In order to achieve significant improvements in the Army's airdrop capability, unconventional and even radical concepts along with more sophisticated techniques must be considered. Concepts must be pursued which provide a greater degree of control over events in lieu of current techniques which permit a great deal of random behavior and acceptance of flight paths determined by nature and the environment. The concept presented here illustrates one specific approach aimed at reducing dispersion by employing multiple exit of troops from the aircraft. This particular configuration was used to illustrate the basic concept because the feasibility, engineering analysis, and design studies have already been conducted in sufficient detail to define realistic operational and physical characteristics for a practical system.

A number of variations and system options of the basic concept are possible, however, no detail analyses have been conducted for all of the various alternatives. For example, a high altitude system rather than the low altitude system described, is entirely feasible. Additionally, gliding decelerators or other devices can be considered for controlled descent and/or offset delivery. Another possible alternative of the basic concept would be to extract personnel in groups but allow individual descent after exit at a time when the high horizontal velocity has diminished.

It is recognized that concepts involving multiple personnel delivery may have greater psychological barriers to overcome than technical barriers. In order for a system of this type to receive acceptance, it must demonstrate a very high level of reliability equal to or better than that associated with other more conventional forms of transportation (container delivery of personnel is just another form of air to ground transport).

The use of a structure or container affords an effective means to increase airdrop system reliability. Most of the functional components can be integrated within the basic structure thereby eliminating the need for individual preparation and assembly of all of the many components such as tie-downs, energy dissipater, load transfer and parachute release mechanisms. The integrated design will also provide a more positive control over sequential events in the airdrop cycle. The suspension slings will be contained on reels within the structure and the pay-out mechanically controlled to maintain tension at all times to minimize tumble and provide uniform and controlled line deployment.

The unit system investment cost is expected to be greater than current airdrop systems, however, the combat effectiveness will be greatly increased and the total costs may be reduced because of increased reliability, availability, capability to airdrop non-parachute qualified personnel and fewer aborted missions because of the ability to operate over a wider range of environmental conditions.

All components for the described concept are attainable utilizing present technology. A functional system could be available in the late 1970's. Considerable refinement for a second generation system can be achieved with expected technological advances during the next 10 years. These advances can be anticipated in areas of energy dissipation, deceleration, altitude sensing and development of new lightweight/high strength materials.

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Ground Proximity Aerial Delivery System
Design Study (Final Report)
Report No. 860
Stanley Aviation Corp.
Jan. 9, 1963

This concept is not purported to offer the best solution to the drop zone dispersion problem but is one of the valid alternatives which should be considered as a potential candidate for solution to this problem.